

CLAIMS

WHAT IS CLAIMED IS:

- 5 1. A low reflection glass article obtained by forming a low reflection film composed of silica fine particles and a binder on a glass base substrate, the low reflection glass article being characterized in that said low reflection film contains said silica fine particles and said binder in a weight ratio proportion of 60:40 to 95:5, and in that said low reflection
- 10 film is formed by coating a coating solution onto the glass base substrate and subjecting it to heat treatment, said coating solution being prepared by mixing
- (1) starting fine particles comprising non-aggregated silica fine particles with a mean particle size of 40-1000 nm and/or
- 15 linear(chain-like) aggregated silica fine particles with a mean primary particle size of 10-100 nm,
- (2) a hydrolyzable metal compound,
- (3) water, and
- (4) a solvent
- 20 and then hydrolyzing the hydrolyzable metal compound in the presence of the starting fine particles.

2. A low reflection glass article according to claim 1, wherein said hydrolyzable metal compound is at least one type of metal alkoxide selected from the group consisting of silicon alkoxides, aluminum alkoxides, titanium alkoxides, zirconium alkoxides and tantalum alkoxides, and said binder is the oxide of the metal of said metal compound.

3. A low reflection glass article according to claim 1 or 2, wherein said low reflection film contains the silica fine particles and the binder in a proportion of 65:35 to 85:15 by weight.

4. A low reflection glass article according to any one of claims 1 to 3, wherein the non-aggregated silica fine particles in said coating solution have a long axis length to short axis length ratio of 1.0-1.2.

5. A low reflection glass article according to any one of claims 1 to 4, wherein the non-aggregated silica fine particles in said coating solution have a primary particle size standard deviation of 1.0-1.5.

6. A low reflection glass article according to any one of claims 1 to 5, wherein said starting fine particles consist only of said non-aggregated silica fine particles with a mean particle size of 40-500 nm.

7. A low reflection glass article according to any one of claims 1 to 5, wherein said starting fine particles consist only of said non-aggregated silica fine particles with a mean particle size of 100-1000 nm.

5 8. A low reflection glass article according to any one of claims 1 to 4, wherein said starting fine particles consist only of said non-aggregated silica fine particles, and said non-aggregated silica fine particles comprise

10 (1) 70-95 wt% of a first type of non-aggregated silica fine particles with a mean particle size of 40-200 nm and

 (2) 5-30 wt% of a second type of non-aggregated silica fine particles with a mean particle size of from more than 200 nm to 3000 nm or less and at least 100 nm larger than the mean particle size of the first type of non-aggregated silica fine particles.

15 9. A low reflection glass article according to claim 6, wherein said low reflection film has 30-3000 fine particles present in a 1 μm X 1 μm square area of the surface of the film as seen from above the film, and the fine particles have a mean particle size of 40-500 nm.

20 10. A low reflection glass article according to claim 7, wherein said low reflection film has 10-50,000 fine particles present in a 10 μm X 10 μm square area of the surface of the film as seen from above the film, and the fine particles have a mean particle size of 100-1000 nm.

11. A low reflection glass article according to claim 6 or 7,
wherein said low reflection film has $5,000,000/D^2$ to $10,000,000/D^2$ fine
particles with a mean particle size D_{nm} of 40-1000 nm present in a $10\ \mu\text{m} \times$
 $10\ \mu\text{m}$ square area of the surface of the film as seen from above the film.

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12. A low reflection glass article according to any one of
claims 1 to 11, wherein said low reflection film has only one fine particle or
2-5 stacked fine particles in the direction of film thickness as seen from a
cross-section taken in the direction of the thickness.

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13. A low reflection glass article according to claim 8,
wherein said low reflection film has 50% or less of its surface area
occupied by fine particles from said second non-aggregated silica fine
particles, as seen from above the film.

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14. A low reflection glass article according to any one of
claims 1 to 13, wherein said binder coats the entire surface of said silica
fine particles to a thickness of 1-100 nm and 2-9% of the mean particle size
of said silica fine particles.

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15. A low reflection glass article according to any one of
claims 1 to 14, wherein said low reflection film has an average thickness of
from 90 nm to 350 nm.

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16. A low reflection glass article according to any one of claims 1 to 14, wherein said low reflection film has an average thickness of from 90 nm to 180 nm.

5 17. A low reflection glass article according to any one of claims 1 to 16, wherein said heat treatment is carried out so that the maximum temperature reached by the glass base substrate coated with said coating solution is 200°C or higher.

10 18. A low reflection glass article according to any one of claims 1 to 17, wherein said low reflection film has a surface roughness (Ra) of 3-50 nm as measured with an AFM (atomic force microscope).

15 19. A low reflection glass article according to any one of claims 1 to 6, 9, 11, 12 or 14 to 18, wherein said glass base substrate is a sheet, and said reflection film has reflectivity of 2% or less for incident light from the low reflection film side of the sheet glass base substrate at an incident angle of 12° with respect to standard light A specified by JIS-Z8720, as the reflectivity including no reflection from the back side of
20 the sheet glass base substrate.

25 20. A low reflection glass article according to any one of claims 1 to 19, wherein said glass base substrate is a sheet, and said low reflection glass article has a haze value of 30% or less.

21. A low reflection glass article according to any one of claims 1 to 6, 9, 11, 12 or 14 to 19, wherein said glass base substrate is a sheet, and said low reflection glass article has a haze value of 1% or less.

5 22. A low reflection glass article according to any one of claims 1 to 5, 7, 8 or 10 to 18, wherein said glass base substrate is a sheet, and said low reflection glass article has a total light transmittance equivalent to or higher than the total light transmittance of said glass base substrate, and a haze value of 10-90%.

10 23. A low reflection glass article according to any one of claims 1 to 6, 9, 11, 12, 14 to 19 or 21, wherein said low reflection glass article is an automobile window.

15 24. A low reflection glass article according to any one of claims 1 to 6, 9, 11, 12, 14 to 19 or 21, wherein said low reflection glass article is a building window, show window, display glass sheet or optical glass member.

20 25. A low reflection glass article according to any one of claims 1 to 5, 7, 8, 10 to 18 and 20, wherein said low reflection glass article is a solar cell glass sheet or solar water heater glass sheet.

26. A low reflection glass article for a solar cell or solar water heater, wherein a low reflection film comprising silica particles and a binder is formed on float glass with a total light transmittance of 85% or greater and a composition of soda lime silicate glass,

5 the low reflection glass article being characterized in that said low reflection film contains said silica fine particles and said binder in a proportion of 65:35 to 95:5 by weight, said binder being coated onto said silica fine particles to a thickness of 1-100 nm, and has a total light transmittance equivalent to or higher than the total light transmittance of
10 said glass base substrate.

27. A method for manufacturing coated glass articles, characterized by mixing

 (1) starting fine particles comprising non-aggregated silica
15 fine particles with a mean particle size of 40-1000 nm and/or linear(chain-like) aggregated silica fine particles with a mean primary particle size of 10-100 nm,

 (2) a hydrolyzable metal compound,

 (3) water, and

20 (4) a solvent,

 in such a manner that said starting fine particles and said metal compound are present in a weight ratio proportion of 60:40 to 95:5 with said metal compound in terms of the metal oxide, hydrolyzing said metal compound in the presence of said starting fine particles to prepare
25 a coating solution, and then coating it onto said glass base substrate and heating it.

28. A method for manufacturing coated glass articles according to claim 27, wherein said hydrolyzable metal compound includes at least one type of metal alkoxide selected from the group consisting of silicon alkoxides, aluminum alkoxides, titanium alkoxides,
5 zirconium alkoxides and tantalum alkoxides.

29. A method for manufacturing coated glass articles according to claim 27 or 28, wherein said coating solution has a starting compositional ratio of 100 parts by weight of said metal compound (in
10 terms of the metal oxide), 150-1900 parts by weight of said starting fine particles, 0-200 parts by weight of a catalyst, 50-10,000 parts by weight of said water and 1000-500,000 parts by weight of said solvent.